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A STUDY OF SOME BIOCHEMICAL INDICATORS OF KIDNEY FUNCTION AND ESTIMATION OF SOME ELEMENTS CONCENTRATION IN THE BLOOD SERUM OF PATIENTS WITH CELIAC DISEASE

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Abstract

Celiac disease is a long-term autoimmune and digestive disorder that damages small intestine. The current study aimed to estimate some important enzymatic and biochemical variables for kidney functions in patients who eat gluten and abstain from it, compare them with healthy ones, see the usefulness of the GFD "Gluten free diet" to improve the health status of patients, and find biomarkers that contribute to the early diagnosis of celiac disease.

The current study was conducted in Nineveh Governorate on patients who came to Al-Salam, Ibn Sina and Al-Khansa Hospital, as well as some private laboratories, as well as some patients from the students of Mosul University, the Technical Institute, and Al-Jada'a and Salamiyah camps after accurate diagnosis by specialist Doctors .

183 blood serum samples were collected for people of both sexes, aged between (2-25) years,. The samples were distributed into three groups, the group of patients who take gluten, including (62) samples (31 males and 31 females), and the group of patients who abstain from eating gluten, which includes (61) samples (31 males and 30 females), as well as the healthy group (control). It includes (60) samples (30 males and 30 females) The results of the current study showed a significant increase in tissue transglutaminase tTG-IgA enzyme for patients taking gluten compared to healthy subjects and no significant difference in enzyme activity in GFD patients compared to healthy subjects at a probability level ($p \leq 0.05$). The results also showed that there was no significant difference in the measurement of creatinine, uric acid and glucose in patients who eat gluten as well as for gluten free diet GFD patients, and a significant increase in the measurement of urea in patients who take gluten compared with the healthy group , and no significant difference in the measurement of urea for GFD patients compared with control. The results also showed a significant decrease in Fe+2, Cu+2, Ca+2, and Zn+2 in patients who take gluten, as well as for GFD patients, compared with healthy subjects at a probability level ($p \leq 0.05$). In conclusion monitoring of these biochemical markers is important in diagnosis and follow-up of celiac patients.

Keywords: Kidney Function; Celiac Disease; Element Concentration; Gluten Free Diet GFD.

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Introduction

Celiac disease is a rare autoimmune disease that causes gluten sensitivity, because it results from the inability of the digestive system to digest the protein of gluten, which affects the mucous layer lining the intestine, causing damage to the villi lining the small intestine, thus leading to chronic inflammation and atrophy of the villi. [1] .

Celiac disease is a major puplic health problem, initialy reported from countries with predominance Caucatian population. Celiac disease is triggered when gluten, which is a component of wheat, rye and barley, is ingested. This protein is rich in glutamine and proline. [2].

Although celiac is known as an injury to the small intestine and results in malnutrition, in recent times this disease has been characterized as a disorder that occurs in the function of many systems in the human body, also the incidence of mental illness, depression and infertility is increased in patients with celiac disease [3] . In another study conducted on autistic patients in Iraq, it was found that three of the autistic cases also have celiac disease[4]

The kidneys work to get rid of excess fluids and waste products through the urine, and to maintain a balance of salts in the blood, and to control blood pressure and regulate some of hormonal functions such as erythropoietin, activation of vitamin D [5] . There is a relationship between celiac disease and kidney disease , In one study conducted on 827 kidney patients, it showed that 54 of them had celiac disease [6].

Among the signs that characterize celiac disease is inflammation in the intestinal layer, as inflammation leads to increased symptoms of malabsorption through the occurrence of diarrhea, and failure to absorb glucose that leads to weight loss, and also swelling and pain in the abdomen as a result of malabsorption, , is characterized by negative serological tests and the absence of villous atrophy, and despite thepresence of intestinal or extra-intestinal symptoms, it can be resolved by a gluten-free diet (GFD) [7] ,therefore, patients with symptoms, clinical signs, or laboratory evidence of malabsorption, chronic diarrhea with weight loss, emaciation, or steatorrhea, flatulence, and abdominal pain immediately after eating should be tested for this disease immediately [8].

The current study aims to find biochemical indicators that help in early diagnosis of celiac disease by estimating the levels of some of the important biochemical variables for kidney function, including creatinine, urea, uric acid, and glucose, and the effect of the concentrations of some mineral elements, including iron, copper, calcium and zinc in the serum of patients with celiac disease who consumed gluten and patients who abstained from it, and its comparison in blood serum of healthy subjects, and also the study of the effect of gender and age group on measuring biochemical variables. The study also aims to demonstrate the effect of the gluten-free diet GFD on the health status of celiac patients and the response to recovery, as well as the importance of GFD on the return of biochemical indicators to normal levels.

2. Practical part

Patients and methods

Samples collection: The process of collecting blood samples from patients arriving at Al-Salam Hospital, Ibn Sina and Al-Khansa, as well as some laboratories, as well as some patients from the University of Mosul and the Technical Institute, and patients coming to the clinics of specialist doctors, and Al-Jada and Al-Salamiya camps after accurate diagnosis by specialist doctors.

183 samples of blood serum were collected for people of both sexes aged between (2-25) years. The samples were divided into three groups. The group of patients who take gluten includes 62 samples, including 31 males and 31 females, the group of patients who did not take gluten includes 61 samples A sample of 31 males and 30 females, and the healthy group (control) includes 60 samples, of which 30 are males and 30 females. The level of creatinine in the blood serum was determined using the analysis kit provided by the French company Biolabo-maizy-france. The level of urea in serum was determined using the analysis kit provided by the Spanish company BioSystems. The level of uric acid in serum was determined using the Biolabo-Maizy-France assay kit. The level of glucose in the blood serum was determined using the British RANDOX company.

Determination of Anti tissue transglutaminase-IgA (tTG-IgA) in blood serum using the analyzing Kit provided by Germany company Diasorin, by using lyson device. The level of zinc, copper, calcium and iron in the serum sample was determined using the Atomic Absorption Spectrophotometer (AAS) technique, based on the standard curve for each element.

3. Statistical Analysis

Statistical analysis was performed using Duncun's SPSS test program and T-test. The differences between the control group and the studied groups for all the studied variables were determined at a probability level (0.05 ≥P)

4. Result:

The results in Table (1) showed that there was no significant difference in measuring creatinine, Uric acid, and Glucose in patients who eating gluten, as well as patients who abstained from eating glutein compared with healthy subjects at a probability level ($p \leq 0.05$), and there was a significant increase in the measurement of urea in patients who eating gluten, and no significant difference in the measurement of urea in patients who abstained from eating gluten compared with healthy subjects at a probability level (p 0.05) The results showed a significant increase in the activity of tTG-IgA enzyme in patients eating gluten compared to healthy samples at a probability level ($p \leq 0.05$), and there was no significant difference in the activity of tTG-IgA enzyme in patients who abstained from eating gluten compared to healthy subjects.

Table (1): The effect of consuming gluten and abstaining from eating (GFD) it in patients and their comparison with healthy subjects on the levels of some biochemical variables

Biochemical variables	Healthy people (N = 60)	Patients taking gluten (N = 62)	Patients who abstain from taking gluten GFD (N = 61)
	Average ± Standard deviation	Average ± Standard deviation	Average ± Standard deviation
Creatinine (Mg / 100mL)	0.96 ± 0.20 A	1.07 ± 0.26 a	0.98 ± 0.16 a
Urea (Mg / 100mL)	24.65 ± 6.04 b	28.16 ± 11.33 a	24.66 ± 5.88 b
Uric acid (Mg / 100mL)	4.59 ± 1.34 a	4.70 ± 1.80 a	4.20 ± 0.97 a
Glucose (Mg / 100mL)	86.16 ± 8.71 a	85.74 ± 25.53 a	85.88 ± 9.59 a
tTG-IgA (AU/mL)	2.01 ± 0.55 b	144.76 ± 34.15 a	4.74 ± 0.38 b

*The difference in letters (a, b, c) indicates that there is a significant difference at a probability level ($p \leq 0.05$) using Duncan's test.

The results in Table (2) showed that there were no significant differences in the estimation of both creatinine and glucose in healthy subjects whose age group ranged between (2-12) years compared to healthy subjects whose age group ranged between (13-25) years. The results showed a significant decrease in the measurement of both urea and uric acid in healthy subjects whose age group ranged between (2-12) years compared with healthy subjects whose age group ranged between (13-25) years, and the presence of a significant increase in the measurement of both Urea and uric acid in healthy subjects whose age group ranged between (13-25) years compared with healthy subjects whose age group ranged between (2-12) years.

Table (2): The effect of age group on levels of some biochemical variables in healthy people and patients who consume gluten and those who abstain from it (GFD)

Biochemical variables	Healthy people (N = 60)		Patients taking gluten (N = 62)		Patients who abstain from taking gluten GFD (N = 61)	
	Average ± Standard deviation		Average ± Standard deviation		Average ± Standard deviation	
	(N = 30) (2-12 years)	(N = 30) (13-25 years old)	(N = 32) (2-12 years)	(N = 30) (13-25 years old)	(N = 31) years) (2-12	(N = 29) (13-25 years old)
Creatinine Mg /) (100mL	0.96 ± 0.20 a	0.97 ± 0.20 a	1.02 ± 0.21 a	1.10 ± 0.23 a	0.99 + 0.19 a	0.97 ± 0.14 a
Urea Mg /) (100mL	22.20 ± 5.93 b	27.10 ± 5.16 a	26.62 ± 6.84 a	29.59 ± 9.74 a	24.80 ± 5.58 a	24.53 ± 6.26 a
Uric acid Mg /) (100mL	3.75 ± 1.02 b	5.44 ± 1.07 a	3.83 ± 1.27 b	5.45 ± 1.96 a	0.97 ± 4.33 a	4.06 ± 0.96 a
Glucose Mg /) (100mL	84.56 ± 7.97 a	87.76 ± 9.24 a	75.46 ± 15.12 b	95.60 ± 20.66 a	83.50 ± 8.37 a	88.26 ± 10.25 a
tTG-IgA (AU/mL)	2.13 ± 0.58 a	1.90 ± 0.40 a	180.82 ± 59.91 a	91.20 ± 29.92 b	5.01 ± 1.38 a	3.62 ± 0.24 b

*The difference in letters (a, b) indicates that there is a significant difference at a probability level ($p \leq 0.05$) using the T-test (T-Test).

The results in Table (2) showed that there was a significant decrease in the measurement of both uric acid and glucose, and there was no significant difference in the measurement of creatinine and urea in patients who eating gluten and whose age group ranged between (2-12) years compared with patients who eating gluten and whose age group ranged between (13-25) years with a probability level ($p \leq 0.05$). The results in Table (2) showed that there was no significant difference in the measurement of creatinine, urea, uric acid and glucose in patients who abstained from eating gluten and whose age group ranged between (2-12) years compared with patients who abstained from eating gluten in the age group Between (13-25) years at a probability level ($p \leq 0.05$). The results in Table (2) showed that there was no significant difference in measuring tTG-IgA enzyme in healthy group whose age ranged between (2-12) years compared with the age group Between (13-25) years at a probability level ($p \leq 0.05$). The result showed a significant increase in the measurement of tTG-IgA enzyme in patients who eating gluten and patients who abstained from eating gluten whose age group ranged between (2-12) years compared with patients who eating gluten whose age group ranged between (13-25) years.

The results in Table (3) showed that there was no significant difference in measuring creatinine, urea, uric acid and glucose, and there was no significant difference in the activity of tTG-IgA enzyme in healthy males compared with healthy females at a probability level ($p \leq 0.05$).

Table (3): The effect of sex on some levels of biochemical variables in healthy people and patients who take gluten and those who abstain from it (GFD)

Biochemical variables	Healthy people (N = 60)		Patients taking gluten (N = 62)		Patients who abstain from taking gluten GFD (N = 61)	
	Average ± Standard deviation		Average ± Standard deviation		Average ± Standard deviation, bj9k8jjh	
	Males (N = 30)	Females (N = 30)	Males (N =31)	Females (N = 31)	Males (N =31)	Females (N = 30)
Creatinine Mg /) (100mL	0.96 ± 0.19 a	0.97 ± 0.20 a	1.09 ± 0.54 a	0.99 ± 0.53 a	1.02 ± 0.18 a	0.94 ± 0.14 a
Urea Mg /) (100mL	24.70 ± 6.56 a	24.60 ± 5.59 a	27.64 ± 5.32 a	27.69 ± 6.05 a	23.82 ± 5.29 a	25.49 ± 6.39 a
Uric acid Mg /) (100mL	4.41 ± 1.38 a	4.78 ± 1.30 a	5.02 ± 1.98 a	4.54 ± 1.64 a	4.38 ± 1.12 a	4.11 ± 0.88 a
Glucose Mg /) (100mL	87.46 ± 9.3 a	84.86 ± 8.01 a	87.04 ± 19.52 a	84.28 ±17.77 a	86.03 ± 11.34 a	85.66 ± 7.57 a
tTG-IgA (AU/mL)	1.78 ± 0.22 a	2.24 ± 0.39 A	133.61 ± 32.36 a	155.25 ± 35.70 a	4.91 ± 0.36 a	3.94 ± 0.32 a

*The difference in letters (a, b) indicates that there is a significant difference at a probability level (p ≤ 0.05) using the T-test (T-Test).

The results in Table (3) also showed that there was no significant difference in measuring creatinine, urea, uric acid and glucose, and there was no significant difference in the activity of tTG-IgA enzyme in male patients who eating gluten compared with female patients who eating gluten at a probability level (p 0.05). The results in Table (3) showed that there was no significant difference in measuring creatinine, urea, uric acid and glucose, and there was no significant difference in the activity of tTG-IgA enzyme in male patients who abstained from eating gluten compared with female patients who abstained from eating gluten at a probability level (p 0.05).

Determination levels of some mineral elements in blood serum:

The results in Table (4) showed a significant decrease in Fe, Cu, Ca , and Zn in the patients eating gluten compared with the healthy subjects at a probability level (p ≤ 0.05), as well as a significant decrease in Fe, Cu, Ca and Zn elements in Patients abstaining from eating gluten compared to healthy subjects at a probability level (p 0.05).

Table (4): the effect of taking gluten and abstaining from eating it (GFD) in patients and their comparison with healthy controls on the levels of some selected mineral elements

Metal elements	Healthy people (N = 60)	Patients taking gluten (N = 62)	Patients who abstain from taking gluten GFD (N = 61)
	Average ± Standard deviation	Average ± Standard deviation	Average ± Standard deviation
Fe (Mg / 100mL)	78.40 ± 15.33 a	45.40 ± 10.44 c	57.43 ± 12.16 b
Cu (Mg / 100mL)	93.21 ± 15.93 a	52.35 ± 15.60 c	68.28 ± 15.58 b
Ca (Mg / 100mL)	9.24 ± 0.36 a	7.31 ± 0.83 c	7.95 ± 0.51 b
Zn (Mg / 100mL)	87.46 ± 13.08 a	55.55 ± 8.95 b	55.45 ± 9.49 c

*The difference in letters (a, b, c) indicates that there is a significant difference at a probability level ($p \leq 0.05$) using the Duncan test.

The results in Table (5) showed a significant decrease in iron, and no significant difference in copper, calcium and zinc among healthy subjects whose age group ranged between (2-12) years compared with healthy subjects whose age group ranged between (13-25) year at a probability level (p 0.05).

Table (5): the effect of age group on the levels of some mineral elements in healthy people, patients who consume gluten, and patients who abstain from eating it (GFD).

Biochemical variables	Healthy people (N = 60)		Patients taking gluten (N = 62)		Patients who abstain from taking gluten GFD (N = 61)	
	Average ± Standard deviation		Average ± Standard deviation		Average ± Standard deviation	
	(N = 30) (2-12 years)	(N = 30) (13-25 years old)	(N = 32) (2-12 years)	(N = 30) (13-25 years old)	(N = 31) years) (2-12	(N = 29) (13-25 years old)
Fe (Mg / 100mL)	72.20 ± 11.84 b	84.60 ± 16.08 a	43.06 ± 9.22 a	47.66 ± 11.22 a	53.76 ± 9.32 b	60.26 ± 13.14 a
Cu (Mg / 100mL)	91.56 ± 17.63 a	94.86 ± 14.13 a	41.13 ± 11.85 b	64.36 ± 8.79 a	65.13 ± 14.53 a	71.43 ± 16.20 a
Ca (Mg / 100mL)	9.20 ± 0.42 a	9.29 ± 0.29 a	7.01 ± 0.96 b	7.68 ± 0.54 a	7.97 ± 0.52 a	7.92 ± 0.51 a
Zn (Mg / 100mL)	88.53 ± 13.28 a	86.40 ± 13.02 a	57.63 ± 9.04 a	54.00 ± 8.46 a	59.60 ± 7.13 a	50.10 ± 9.01 b

*The difference in letters (a, b) indicates that there is a significant difference at a probability level ($p \leq 0.05$) using the T-test (T-Test).

The table also showed that there was no significant difference in iron and zinc, and the presence of a significant decrease in copper and calcium in patients eating gluten and whose age group ranged between (2-12) years compared with patients eating gluten and whose age group ranged between (13 -25) years at a probability level ($p \leq 0.05$).

The results in Table (5) also showed a significant decrease in iron, no significant difference in copper and calcium, and a significant increase in zinc in patients who abstained from eating gluten and whose age group ranged between (2-12) years compared to patients who abstained from eating gluten and whose age group ranged between (13-25), at probability level of ($p \leq 0.05$).

Table (6): the effect of sex on levels of some mineral elements in healthy people, patients who consume gluten, and patients who abstain from eating it (GFD).

Biochemical variables	Healthy people (N = 60)		Patients taking gluten (N = 62)		Patients who abstain from taking gluten GFD (N = 61)	
	Average ± Standard deviation		Average ± Standard deviation		Average ± Standard deviation	
	Males (N = 30)	Females (N = 30)	Males (N =31)	Females (N = 31)	Males (N = 31)	Females (N = 30)
Fe (Mg / 100mL)	78.63 ± 17.39 a	78.16 ± 13.26 a	45.40 ± 8.54 a	44.50 ± 11.0 a	61.16 ± 10.52 a	52.66 ± 11.20 b
Cu (Mg / 100mL)	94.80 ± 15.18 a	91.93 ± 16.75 b	51.50 ± 11.69 a	54.66 ± 12.45 a	70.23 ± 14.48 a	67.80 ± 13.10 a
Ca (Mg / 100mL)	9.20 ± 0.37 a	9.29 ± 0.36 a	7.42 ± 0.92 a	7.22 ± 0.75 a	8.02 ± 0.52 a	7.92 ± 0.53 a
Zn (Mg / 100mL)	86.46 ± 13.02 a	88.46 ± 13.29 a	54.56 ± 9.81 a	55.36 ± 8.29 a	58.70 ± 7.47 a	51.00 ± 9.60 b

*The difference in letters (a, b) indicates that there is a significant difference at a probability level ($p \leq 0.05$) using the T-test (T-Test).

The results in Table (6) showed that there was no significant difference in iron, calcium and zinc, and there was a significant increase in copper in healthy males compared with healthy females at a probability level (p 0.05). The results in Table (6) also showed that there was no significant difference in iron, copper, calcium and zinc in male patients compared with females eating gluten at a probability level (p 0.05). The table also showed that there was no significant increase in iron and zinc, and there was no significant difference in copper and calcium in male patients compared with female patients who abstained from eating gluten at a probability level (p 0.05).

5. Discussion:

In the results of the statistical analysis of the current study, the levels of urea, creatinine, and uric acid appeared close to normal levels, and some suffered from a slight increase in the levels of urea, creatinine and uric acid, and others in which the level of creatinine and uric acid decreased below the normal level in patients who take gluten, and this indicates the occurrence of disturbance in the function of the kidneys, which is an indication of the onset of celiac disease effect on kidney function .The results of the current study are in agreement with the study that showed a slight increase in the level of uric acid and a non-significant decrease in the level of creatinine in patients eating gluten compared to healthy subjects [9] .The results of the current study also agreed with the study in which glucose levels came within the normal range, but the levels of creatinine, urea and uric acid showed an increase from the normal range of the studied cases, as the researcher proved that there is a clear relationship between celiac disease and kidney disease[10]

A study of celiac patients who also suffered from hepatitis B virus indicated that the creatinine level in some of the studied cases decreased below normal levels [11]. Another study showed that there is a high level of creatinine in patients with celiac disease and

kidney disease who eating gluten [6]. A study has shown that there is an increase in the enzyme tTG-IgA in celiac patients who eating gluten, and that the level of this enzyme decreases by following the GFD for several months, as the patients must undergo repeated tests to monitor the levels of this enzyme [11] . This finding is in agreement with the results of the present study. Also, a study by Góra-Gębka and his group in 2014 [12] clarified that one of the 12-year-old cases studied showed that there was a high increase in the tTG enzyme in a patient who was found to have celiac disease after the biopsy and the high enzyme levels returned to normal after following the GFD regimen for several months. In another study conducted by the researcher Umair and his group in 2017[13], the enzyme showed that tTG-IgA levels decreased after following the GFD regimen.

A study conducted on 487 children demonstrated that there is an increase in tTG-IgA enzyme levels in celiac patients who take gluten, and these levels gradually return to normal by following the GFD regimen, as the proportion of these levels in children equaled 65% after 407 days had passed since they followed the GFD system [14]. However, patients with type 1 diabetes are less likely to have normal levels of this enzyme, and this takes as long as 1204 days compared to non-diabetic celiac patients [15] . The results of the current study are in agreement with this study, as the levels of this enzyme return to normal whenever patients stick to the GFD regimen for a long time.

In another study conducted by the researcher Mule and his group in 2018 [16] on 94 patients, which proved that all patients had a high tTG-IgA enzyme in patients who consumed gluten and how the percentage of these enzymes decreased after following the GFD diet, as the tests were performed again after one month and then three months Then, six months later, after starting the GFD diet. Another study demonstrated that some cases of GFD patients had decreased levels of tTG-IgA after 3 months, and some needed a longer period than that [14]. In addition to what appeared in the results of the statistical analysis, some of the results of the current study showed a severe decrease in the levels of mineral elements, some of which appeared within the near-normal range, and a clear difference appeared in iron, calcium, zinc and copper, which was represented by a decrease in patients eating gluten compared to what appeared in patients Those who abstained from eating it, as the levels of iron and calcium tended to a greater extent towards the near-normal values and to a lesser extent for the element copper, while the results showed no significant improvement in the level of the zinc component in patients who abstained from eating gluten, due to malabsorption and malnutrition and may require a period Long-term persistence of patients on the GFD diet. People with untreated celiac are more likely to have a deficiency of a number of micronutrients than healthy people without celiac, such as iron [17].

The study of Harper and his group in 2007 [18] proved that there is a deficiency of iron in male patients, equivalent to 31% , female patients 19% and anemia occurs in 20% of patients eating gluten. In another study it indicated that 34% of patients have anemia and iron deficiency [19] , The diet should not only be gluten-free, but also healthy to avoid a lack of nutrients, vitamins and minerals [20] , as seen in the results of the current study, due to the malabsorption caused by malnutrition, and patients must also take nutritional supplements to compensate The missing nutrients, vitamins and minerals. The diet should not only be gluten-free, but also healthy to avoid a lack of nutrients, vitamins and minerals [20] . Following the GFD system leads to treatment of anemia. The results of the current study also agreed with the study in which iron levels were lower than normal levels in patients who consumed gluten compared to healthy subjects [21] . Several studies also indicated that the prevalence of anemia among people with celiac is estimated at 12-40% for children. And 23-48% for adults [22,23]. The study by Laurikka and his group in 2018 [3] also proved that anemia is a common feature of untreated celiac patients in all age groups, and it is expected that its prevalence will decrease over time if the disease is diagnosed early with the improvement of the nutritional status and the GFD diet in general for children.

The There is a relationship between Cu deficiency and celiac disease, and copper levels return to normal levels within one month of taking nutritional supplements with a GFD gluten-free diet [24] .

Several studies have reported that malabsorption diseases such as celiac disease lead to deficiency of many minerals essential for the body such as iron, copper and zinc due to malnutrition [25] .

In another study, it was indicated that celiac disease leads to copper deficiency due to poor absorption, and that blood abnormalities have been attributed to copper deficiency in patients with celiac disease [26] .

The study by Botero-Lopez and his group in 2011 [27] indicated a deficiency of mineral elements in celiac patients, including iron, copper and zinc, and it is possible for the zinc level to return to normal levels after following the GFD diet [25] . In another study it was reported that 67% of patients suffer from zinc deficiency, 32% of them suffer from anemia, and 25% of them suffer from iron deficiency, and there are no differences between both sexes in patients who take gluten [28] .

Calcium deficiency and metabolic bone disease are comorbidities for celiac patients, as approximately 75% of newly diagnosed patients of celiac disease have decreased bone mineral density [29]. Thus, osteoporosis is one of the hallmarks of celiac disease. diet should not only be gluten-free, but also healthy to avoid a lack of nutrients, vitamins and minerals [20] ,as seen in the results of the current study, due to the malabsorption caused by malnutrition, and patients must also take nutritional supplements to compensate The missing nutrients, vitamins and minerals.

Simultaneously, follow-up of CD patients on a GFD is critical to assess responsiveness to the GFD, detect complicated CD, identify associated autoimmune diseases, and identify metabolic alterations induced by the GFD. [30] .

Celiac disease, on the other hand, is largely underdiagnosed in developing countries and has a greater impact on children [31,32].

Conclusion:

Celiac disease affected some kidney functions in patients compared to healthy subjects, and there are differences in the values of mineral elements in patients compared to healthy patients due to damage to the intestinal layer and the inability of the intestine to absorb well, and as a result, a decrease in the concentration of these elements in the blood serum due to malabsorption, which leads to the development of the disease. The GFD gluten-free diet has a positive effect on improving the clinical condition of patients, and improving their biochemical parameters, there is an effect of sex and age on some biochemical variables related to the disease.

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